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ABSTRACT

A study was conducted to develop a procedure by which secondary and postsecondary articulation could be improved in a selected trade and industrial program (welding). Thirteen high school teachers were surveyed using a list of 560 tasks to determine what high school programs they were teaching. Results of this survey were used to develop a certificate of achievement that would effectively identify the competencies students have learned. (The task list sent to high school welding instructor and the certificate of achievement are appended.) (LRA)

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FINAL REPORT

Project No. 14-0C1-150-319

ARTICULATING SECONDARY AND POST-SECONDARY VOCATIONAL EDUCATION CURRICULA

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July 1979

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The Certificate of Competencies could not have been completed without the cooperation and input from the high school welding instructors. A special thanks is in order to the Local Vocational Education Coordinators who contributed their time, effort and expertise. Also, gratitude is expressed to the welding instructors of Mid-State Vocational, Technical Institute for their valuable input.

MF
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DH

ABSTRACT

A study to develop a procedure by which curriculum articulation could be improved in a selected Trade and Industrial program within the Mid-State VTAE District was conducted during the winter of 1978-79 at Mid-State Vocational Technical Institute.

Thirteen secondary schools of the Mid-State VTAE District were involved. The welding program was selected and compared with welding programs of the high schools.

The variations in welding programs throughout the District was significant.

It was decided that the best method available to articulate the welding programs would be a certificate of competencies which could be adopted on a District wide basis.

This certificate was developed through cooperative efforts of the welding instructors of the Mid-State VTAE District, the LVEC's, and the writer of this report.

The certificate of competencies is designed so the high schools can identify the skills learned by the students. The students can then receive credit for these skills when they enter the Mid-State Vocational Technical Institute by presenting the certificate to the welding instructor at Mid-State Vocational Technical Institute.

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I. INTRODUCTION

The major goal of post-secondary vocational education is to prepare students for job entry level positions in employment and to enable them to advance in their selected occupations.

Some high schools in Mid-State VTAE District have sophisticated programs in vocational areas. In those cases where students graduate from strong secondary vocational education programs and desire to get additional training, the post-secondary VTAE schools must be flexible enough to meet the needs of these students. The advanced training requirements of these students have in the past conflicted with the needs of the majority of the students in many of the traditionally structured programs at Mid-State VTAE District.

This research effort is designed to determine and develop a Certificate of Competencies for a selected program within the Mid-State VTAE District. This Certificate of Competencies will coordinate the efforts of the secondary schools with the efforts of Mid-State VTAE institute in a selected program.

THE PROBLEM

The problem is lack of vertical curriculum articulation between the high schools and Mid-State Technical Institute in Trade and Industry programs.

A privileged number of secondary schools within the Mid-State VTAE District boundary have developed sophisticated programs in many trade areas to the degree that their course offerings and content are similar in depth and breath to a number of the programs offered in the Mid-State VTAE Institute. On the other hand, there are secondary schools within the district which provide none or only a few vocational education courses with content geared to limited equipment and space. This large variation in courses available results in students who have a wide variation in background when enrolling at Mid-State Technical Institute.

This broad variation in students background has been verified by previous studies. Those programs which need improvements to withstand these pressures are the Mid-State VTAE District's one-year diploma welding program, two-year auto mechanics and two-year machine shop.

The effect that this has had is far reaching. There is concern that students are not enrolling in some of our trade programs because they have heard that it is a repeat of what they had in high school. Other students may enroll and then become disenchanted and withdraw from the program because they find the early part of the program repetitious of what they learned in secondary institutions in the district. Still other students are suffering from a lack of previous experience, and are struggling to keep up with their classmates who are better prepared. These students, too, are often a drop out problem. When developing a

program and its content to such varied student needs, it is obvious that few students needs are met adequately.

The challenge of this study is to articulate the high schools in the Mid-State VTAE District with Mid-State Technical Institute. The students need a reasonable guarantee that they will not be confronted with a gap in their vocational training experiences nor will they find a large portion of their training repetitious.

The traditional philosophy of vocational education of taking students from where they are in their learning experience and providing them with the required learning experiences to allow them to grow to their full potential must be applied.

OBJECTIVES

The primary objective of this study is to develop a procedure which will coordinate a selected curriculum in the high schools in the Mid-State VTAE District with Mid-State Technical Institute curriculum. The student enrolling in post-secondary programs may be assured that they can progress smoothly through the course without encountering any voids or duplication in their education.

A secondary objective is to improve public relations between the high schools in the Mid-State VTAE District and Mid-State Technical Institute.

DEFINITION OF TERMS

Articulation

Interrelations of different levels of education for ensuring continuous advancement of learning.

Articulation, Horizontal

The relationship between programs, courses or activities which exist at any one education competency level and provide a coordinated educational program for the student.

Articulation, Vertical

The relationship which exists between institutions, programs, courses or activities and provides coordinated programs for students moving from one education level to the next.

A.W.S. (American Welding Society)

A society of welders which promotes standardization of welding terminology and practices.

Advanced Placement

A status granted to an incoming student on the basis of proficiency gained through maturity of work accomplished elsewhere at other levels. Prerequisites are waived but total credits required for graduation are not reduced.

Advanced Standing

A status granted to a student for courses previously taken or on the basis of proficiency examination where the individual is granted credit which serves to reduce the total credits required for the completion of the program.

Capstone Course

The final course in a sequence, generally a senior year offering which leads to the development of employable skills, attitudes and characteristics. (May lead students to post-high school vocational-technical programs.)

Competency

The ability to satisfactorily perform a specific job related task to a specified level. This would include the personal judgment, knowledge and physical performance needed to accomplish the task.

Criterion-Referenced Measure

A measurement based on a performance objective, the accomplishment of which measures the attainment of that objective.

L.V.E.C. (Local Vocational Education Coordinator)

A public school vocational education staff member who has responsibility of vocational education programs. This person works with all departments relating to vocational education programs, conducts or assists in in-service programs, helps establish and utilize steering or advisory committees, liaisons with community resources including the employment service, the vocational-technical schools, labor and employer groups, etc.

Performance Objective

A statement in precise measurable terms a particular behavior to be performed by a learner under specified conditions.

Task List

A list of tasks performed by incumbent workers within a given occupation.

VTAE (Vocational-Technical and Adult Education) District

Area post-secondary vocational, technical and adult school districts legislated and designed to provide a wide-range of occupational training programs and services.

V-TECS (Vocational-Technical Education Consortium of States)

A group of States which have been legally constituted to work together for the purpose of sharing knowledge and solutions to common problems in vocational-technical education.

II. REVIEW OF LITERATURE

What is Articulation

Much has been written about articulation. There are many definitions given, and the ways of applying these definitions are varied. The lack of articulation is listed in many articles and studies as being a barrier to post-secondary enrollment, as a contributing factor in drop-out rates, and a hinderance to job placement.

What is articulation?

Stanley Spanbauer (1977) defines articulation in these words:

> "Articulation is communication, coordination and cooperation between secondary and post-secondary educators, designed to pave the way for smooth progress of students through their education to a place in the world of work."

Marilyn Artis (1977) in a project titled "Model For Articulated Vocational Education" (MAVE) described articulation as follows:

> "Articulation is the means used to provide sequence and continuity in curriculums and programs and to provide needed growth and an uninterrupted sequence of learning experiences for students progressing from elementary to secondary and community colleges in both unit and dual districts."

Articulation is also defined in Webster's dictionary as: "The action or manner of joining or interacting" and also as "The act of giving utterance or expression."

It is possible that the difference between the many definitions of this word has contributed to the large variations in the way these definitions are applied. The addition of "vertical articulation"

and "horizontal articulation" increased the confusion.

Wilbert Knobeck (1977) defined vertical articulation and horizontal articulation as follows:

> "Horizontal articulation is the relationship between programs, courses or activities which exist at any one education competency level and provide a coordinated educational program for the student."
>
> "Vertical articulation is the relationship which exist between institutions, programs, courses or activities and provide coordinated programs for students moving from one educational competency level to the next."

The Need For Articulation

Clifton Campbell (1977) sights several reasons for the rising interest and need for articulation. The first is a result of the public demand for accountability tied in with declining enrollments. Schools need students to maintain programs, and the competition for students is forcing many schools to articulate.

The duplication of effort at separate levels of education creates a need for articulation to smooth transfer of students from one level of education to the next. Also sighted as a thrust for articulation by Campbell, is the fact that the age of students is becoming less important for post-secondary institutions as many students are involved in dual enrollment--part time high school,part-time Vocational Technical School or Community College. The need to facilitate more opportunities for bright students in this manner is also prompting articulation. Campbell explains that no articulation

plan will solve all problems. However to maintain maximum local control and taxpayer support, the profession must develop voluntary cost-effective cooperation.

David Bushnell (1978) points out that the high schools have a very large percentage of students who receive vocational training. Industry needs the skills which vocational training can and should provide. The need for articulation, as Bushnell sees it, rises out of industries' need for manpower development at reasonable costs. Vertical articulation can provide the students with transferable credits which will make manpower training at different educational levels more cost effective.

The need for articulation in Vocational Technical Education does not end when students complete their studies at a vocational technical institute. Often they establish new career goals which require four-year degrees. When this is the case, students need assurance that they can transfer to a four-year college or university without repeating courses. E. Michael Walsh (1978) in an article titled "Articulation Problems of Vocational-Technical Students" brought this need to light. Walsh listed several obstacles the two-year vocational technical school graduates must overcome at most four-year colleges and universities. These obstacles included such things as: four-year institutes refusal to accept occupational course credits, acceptance of occupational courses for partial credit, and a lack of programs which focus on a single career or career cluster.

Walsh endorsed the use of student designed programs. This would involve students designing their programs of study with an advisor which would meet individually defined career goals of the student. Such flexibility would encourage more students to make better use of four-year colleges and universities.

In 1978 the Junior-Senior College Relations Committee of the American Association of Collegiate Registrars and Admissions Officers (AACRAO) surveyed 23 states which reported the existence of some type of formalized statewide articulation agreement. The Committee feels the results are significant. The conclusion of the survey was:

> "All states are interested in articulation. Everybody talks about the need for better and improved positions in working out agreements at state level between two year to two year, two year to four year, and four year to four year schools. Lateral articulation is just as important and necessary as vertical...There still remains much work to be done, even in those states where indication was given that they have an excellent work agreement.
>
> "Areas which need further articulation include: Vocational/technical courses, non-traditional learning experiences and credit, clarification of existing agreements in what constitutes the 60 hours to meet degree requirement and fulfillment of the general education requirements, degree of implementation, and interpreting the agreement to suit one's own ends."

The AACRAO study strongly supports articulation.

Models For Articulation

There are many research documents which are devoted to outlining a procedure or model for articulation efforts.

Spanbauer (1977) maintains that changes need to take place to improve articulation practices. Spanbauer states that articulation must be viewed with recognition that the student is the focal point. Articulation must take place with the students' needs being of prime importance. The students' needs must be placed ahead of the needs of programs, institutions, and other vested interests. Seven key elements are seen by Spanbauer as being absolutely essential for successful articulation:

"1. Planning-the faculty must be directly involved in the operational phase if it is to have any appreciable impact on actual school practices.

"2. Competency-based Delivery-there must be a commitment to competency based instruction as the vehicle for delivery of vocational education.

"3. Job Task Related Instruction-instruction, in order to be relevant, should be based on careful analysis of tasks actually performed on the job.

"4. Program Flexibility-post-secondary schools must develop programs which have the flexibility to grant incoming students advanced standing and school credits for post learning experiences.

"5. Implementation Consistent with Local Philosophy, Needs, and Preferences-implementation phase moves forward based on priorities established by each school. There are no attempts to change overall philosophy, objectives, instructional methodology, or management of individual schools. The only requirement of participation of staff is a commitment to continuous communications with other educators, at both levels, and a desire to strive towards fulfillment of the articulation priorities and goals.

"6. Staff-In-Service Programs-there is a need for continuous in-service activities to enable vocational educators to develop new skills in analyzing survey data, writing instructional objectives, preparing instructional materials and evaluating students performance.

"7. Progress Review and Evaluation-the process is self-reviewing. The last step in the sequence is to start over again following an assessment of the completed activities.

Knobeck (1977) lists several inferences and recommendations in his study on "Developing and Validating an Articulation Model for Trade and Industrial Vocational Education." Several recommendations worthy of note are:

"School visitations between educators of both institutional levels should be encouraged on a reciprocal basis" and "A statewide communications network should be established to foster transportability of progress reports and accomplishments."

"The State Director and State Superintendent should continue to provide top level endorsement of the necessity for cooperative articulation efforts. More emphasis should be placed on communication of this support to local instructors both at VTAE and high school levels."

John Farah (1978) illustrated in his research at the Wisconsin Board of Vocational Technical and Adult Education (WBVTAE) some proven techniques of planning and implementing curriculum articulation efforts between high schools and post-secondary educational programs. Farah's study analyzed several studies, and he included a flow chart which could serve as a guide to articulation efforts. The flow chart brings together a committee of secondary Local Vocational Education Coordinators (LVEC's) with the post-secondary coordinators. The outcome of the committee is an articulation committee which determines areas of need, develops competency lists, compromises competency lists,

finalizes competency lists, and summarizes the articulation results.

Farah suggests several sources of initial competency listings. He strongly endorses the use of Vocational Technical Education Consortium of States (V-TECS), Dictionary of Occupational Titles (DOT) and Education Research Information Center (ERIC). After the competencies have been prioritized, ranked, and revised, the secondary and post-secondary school teachers should be called together for another meeting. It is then recommended that the schools involved come to some agreement as to which competencies the secondary school will teach and which competencies the VTAE school will teach. Proficiency tests are recommended as a means of eliminating gaps and overlaps in students' training when they move from secondary to post-secondary vocational education.

Artis (1977) in her study done for Illinois Office of Education developed an articulation guide referred to as MAVE. The recommendations proposed by Artis are similar to those proposed in a study done in Minnesota. The Minnesota study by Fuehrer (1972) is referred to as the "Minnesota Statewide Curriculum Articulation Model." Both studies recommended the following:

> Identification of local priorities - This includes the identification of barriers as well as strengths within the area or district being articulated.
>
> Determine Goals and Objectives - In this area the development of a climate of cooperation is a must and is a responsibility of top administrators.

After these initial agreements, the two studies differed slightly in the procedures recommended. The Minnesota study recommended the development of task lists, competency records, performance objectives, tests, and instructional materials. The Minnesota study recommended that each of these steps be verified before proceeding to the next.

The final step is a verification of the effectiveness of the final results of the whole articulation process and a possible repeating of the whole procedure. Artis (1977) concentrated on outlining procedures and ways to develop and improve the channels of articulation with K-16 personnel, and she concentrated less on the content of the articulation.

Transfer of Credits

The area of articulation which becomes "clouded" in many reports and studies is the area regarding procedures for the recording of credits for skills and competencies of incoming students by receiving institution. This subject was dealt with by Knobeck (1976) in a study of curriculum articulation. Knobeck separated credit transfers into two areas: Advance Placement and Advance Standing. Advance Placement meaning the incoming student may be granted advanced placement based on proficiency; prerequisites are waived, but total credits for graduation are not reduced; and the student would have to take electives to make up for the credit deficiency because of the advanced placement. Advanced Standing, on the other hand, would provide students the opportunity to be placed on advance competencies or possibly even complete write-off of a course/s with credit by demonstrating proficiency. In advance standing the student benefits from previous experiences because he/she can graduate sooner. Therefore, this earlier graduation enables him/her to become employed sooner.

Competency Articulation

In the area of competency articulation several sources have been developed. V-TECS has catalogs of performance objectives for many skill areas. The catalog this writer found most useful is the V-TECS

catalog "Combination Welding." The primary source of performance standards used in this catalog is job-based. Information provided in technical manuals and certification requirements is used to support the job-based information. The material found in V-TECS' has been incorporated into many studies done on competency based curriculum articulation.

A study done at Keene State College of New Hampshire (1977) used V-TECS' as a primary source in the development of secondary to post-secondary vocational articulation in auto mechanics and welding. The study has tables of "articulated" skills with performance objectives for each task. This list or table also indicated which skills would be taught at each institutional level.

Several other studies followed nearly the same format as the Keene study. John Pierson (1974) and Vincent Kenneth (1973) completed studies in the area of welding articulation. The Pierson study concentrated on Gas Tungsten-Arc (TIG) welding while the Kenneth study developed articulated materials for the intermediate welding skill area.

Bragg and Hunter (1977) made an effort to improve on the V-TECS' welding catalog by performing additional verifications of the tasks listed in V-TECS and by expanding the task list through instructor input, advisory committees, and tradesmen.

Nebraska Education Service Unit 6 (1977) made a study on welding competencies for articulation in Lincoln Public Schools of Nebraska. They developed a detailed task list with performance objectives and criterion referenced measures which were the bases for agreement for the competencies articulated.

Very few of the studies made mention of methods used by receiving institutions to give students credit for competencies learned. Most of the studies made efforts to restrict what the high schools would teach in order to eliminate overlap.

Hobart School of Welding Technology (1975) has an excellent training workbook available. This workbook covers all phases of welding. The history of welding is traced back to 1000 B.C. The Hobart School publication is also an excellent source of definitions of welding terms. With each specific welding task is listed the materials and equipment to be used. The objectives for each exercise and the methods of evaluation are clearly stated. The design also facilitates self-paced instruction. In conjunction with V-TECS, the Hobart Training Workbook provides an excellent list of competencies, performance objectives and criterion referenced measures.

III. METHODOLOGY

Limitations of Study

This study will be limited by three factors which may restrict the application of the results. This study will be limited to the geographic area which is defined by the boundaries of the Mid-State VTAE District. A map of the Mid-State VTAE District with its boundaries is shown in Figure 1 page

The study will be further limited to one of the following curriculum areas of the Trade and Industrial Department: auto mechanics, machine tool, or welding. The selection of a specific program will be made with the input of the LVEC's in the Mid-State VTAE District.

Once the specific program has been selected, the study will be limited to those high schools in the Mid-State VTAE District which are teaching the selected subject.

Design of Study

This research effort is designed to determine and develop a certificate of competencies for a selected program within the Trade and Industrial Department of the Mid-State VTAE District. This certificate of competencies should coordinate the efforts of the secondary schools with the efforts of Mid-State Vocational Technical Institute in the selected program area.

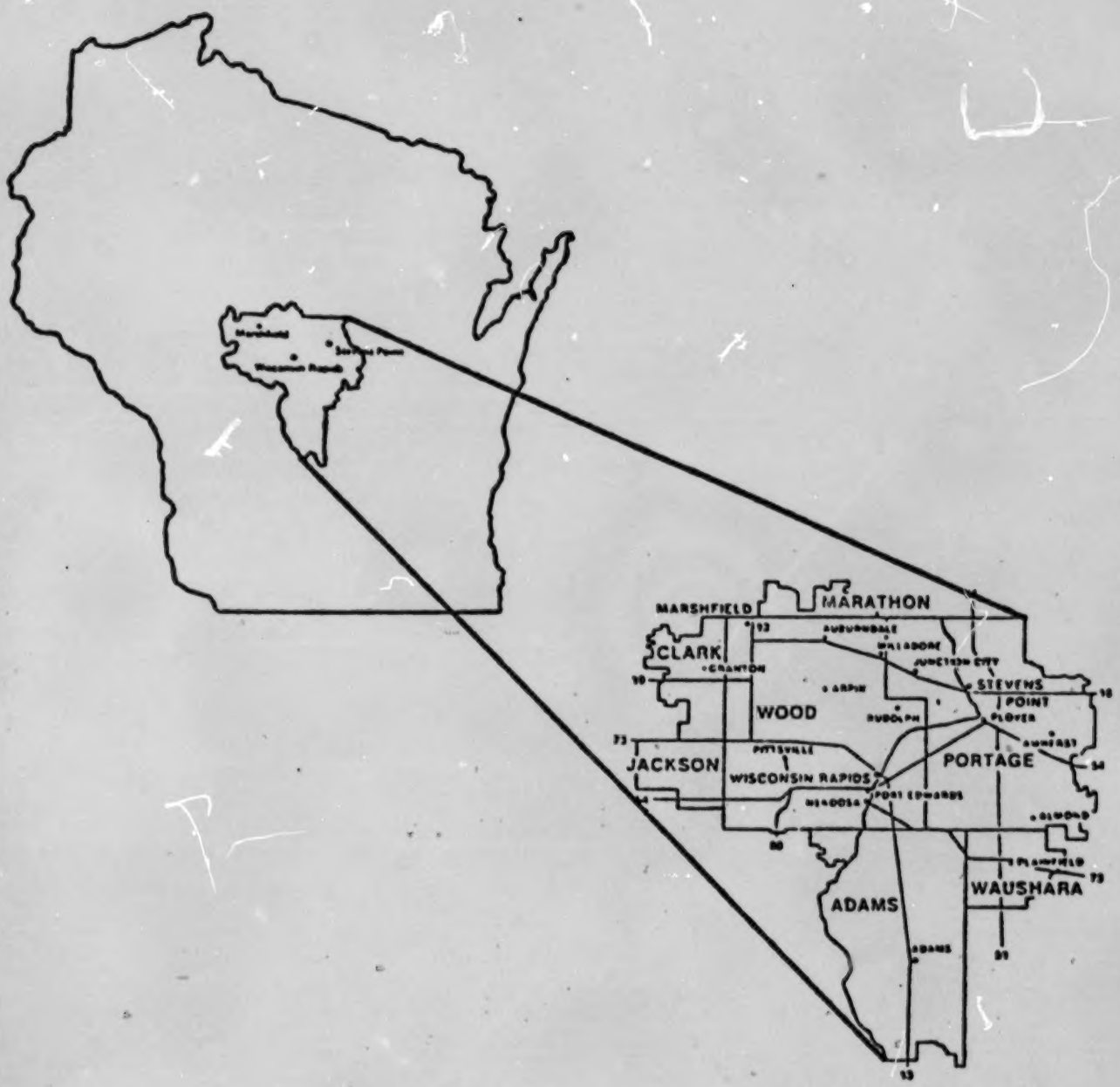

Figure 1

A GRAPHIC DEPICTION OF THE AREA SERVED BY
MID-STATE VOCATIONAL, TECHNICAL AND ADULT EDUCATION DISTRICT

The certificate of competencies will be constructed so that the secondary schools can effectively identify the competencies which the student has learned. The degree or level of proficiency which the student being rated has achieved on each competency will also be recorded.

The trade and industrial areas: auto mechanics, welding, and machine tool, at Mid-State Vocational Technical Institute, are set up so that the competencies learned by students at the high schools level and identified on the certificate may be accepted. The Mid-State Vocational Technical Institute is prepared to accept competencies which the student has learned in high school, and will not require students to repeat those shop skills in which he/she is competent. In this way the student's progress towards employment will not be hampered by unnecessary overlap or gaps in his training.

Activities

This study required the close cooperation of trade and industrial instructors in the high schools. For this reason, it was felt that it was essential to decide quickly which subject area to concentrate on.

Through previous articulation efforts at Mid-State Vocational Technical Institute, a list of contact persons had been developed. This list was updated by making phone calls to confirm any doubts about personnel changes that might have taken place in the high schools (see Appendix A). The LVEC's were contacted, some by

phone, some by letter and others in person. The LVEC's were all invited to a meeting at Mid-State Vocational Technical Institute to discuss articulation and to give their input into the selection of the program which they felt would benefit the most students. At this meeting it was decided that the program which could benefit the most students by being vertically articulated was welding (see Meeting Minutes Appendix B).

The welding instructors of Mid-State Vocational Technical Institute and the welding instructors of the high schools were then contacted in person to solicit their cooperation and support for the articulation of welding curriculum.

A task list was developed and the high schools and Mid-State Vocational Technical Institute welding instructors were asked to identify the skills taught in their program to determine the extent of overlap and gaps in the welding training throughout the Mid-State VTAE District.

The task list was compiled by use of several sources: The VTECS Catalog, Hobart Training Manual, and welding course outlines provided by instructors.

Before the task list was sent to the high school instructors, it was verified by the welding instructors of the Mid-State Vocational Technical Institute. The task list was then mailed to the welding instructors in the 13 high schools in the Mid-State District which teach welding (see Task List in Appendix C).

After the task lists were completed and returned, the data was analyzed. Then the certificate of competencies was developed.

IV. GATHERING DATA

Welding is taught in thirteen secondary schools throughout the Mid-State VTAE District (see List of Schools in Appendix A). To determine the extent of overlap and gaps in the welding training as students progress from secondary schools to Mid-State Vocational Technical Institute, a task list was mailed to all thirteen welding instructors with instructions for completion (see Appendix C). The welding instructors at Mid-State Vocational Technical Institute were also asked to fill out the task list using the same instructions.

Seven of the 13 high school instructors returned the task list by mail. The remaining six lists were collected by making personal visits to the welding instructors. The instructors were asked to indicate which tasks were taught in their welding program. The degree or level of proficiency that the students attained was not requested. The results are shown in Table #1 page 22. The task list was divided into four major areas: general welding, safety and theory; oxyacetylene welding practice; shielding metal arc welding practice; and Mig and Tig welding practice. Each of these areas were broken down further. In the safety area the instructors were to respond to each item as it pertained to the heading of each column which identified different types of welding.

In the practice areas, the different types of joints and positions were listed. The instructors were to indicate which joints and positions they taught under the heading in each column. These headings identify types of filler materials and welding machines.

V. ANALYZING DATA

To analyze the data on the task list which were received from the high schools, all of the responses were tabulated and recorded on Table I (see Table I page 22). The numbers which are in each cell indicate the number of instructors out of 13 who indicated that they teach the identified task to some level of proficiency.

No school claimed to teach all of the tasks. Of the 560 tasks, only seven tasks were taught by all of the 13 high schools. There were 240 tasks not taught by any of the high schools. Of the 320 tasks which are being taught, the number of schools teaching these tasks range from one to 13. (For example on page 22, Task I.A.3.a. Safety Fire Extinguishers, 10 schools indicated they teach this task as it pertains to gas welding).

Oxyacetylene welding skills were taught by the largest number of high schools followed by shielded metal arc, Mig and Tig.

The wide variation in the number of schools teaching each task supports the assumption that gaps and overlaps do exist.

TABLE #1: Analysis of tasks as taught in the high schools within the Mid-State VTAE District*

MID-STATE TECHNICAL INSTITUTE
Wisconsin Rapids Campus

WELDING

	Gas	Shielded Metal Arc	MIG	TIG
I. Safety				
A. Shop Safety				
1. Materials (Handling & Storage)	11	10	4	4
2. Ventilations	11	10	4	4
3. Fire				
a. Extinguishers	10	9	0	0
b. Fire classification	5	5	0	0
c. Fire blankets	6	6	4	4
4. Compressed air usage	8	6	4	4
5. Combustibles				
a. Storage	8	7	3	3
b. Handling	9	8	3	3
6. Injury reporting procedure	11	11	7	7
7. Floors & passageways	11	11	7	7
8. Attitude	11	11	8	7
B. Tool Safety				
1. Hand tools	12	12	6	6
2. Power Tools				
a. Drills	9	8	4	4
b. Press	7	6	2	2
c. Grinders	12	10	5	5
d. Shears	8	7	4	4
e. Power saws	9	8	5	5
f. Weld testing machines	1	2	2	1

*The data in the cells indicate the number of high schools within the Mid-State VTAE District that stated they teach these tasks to some level of proficiency. When the number in the cell is less than "13," the number after subtracting from 13 indicates the number of high schools not teaching the task.

(Table continued on following page)

(Table I continued)

Welding Page Two	Gas	Shielded Metal Arc	Mig	Tig
C. Clothing Safety				
1. Helmets and goggles	11	11	8	7
2. Rings, watches & jewelry	10	10	7	7
3. Hair protectors	7	8	5	5
4. Safety shoes	5	5	4	4
5. Fire retardant aprons & vests	8	8	4	5
D. Eye Safety				
1. State laws governing eye protection	6	6	3	3
2. Types of approved glass	7	7	5	5
3. School regulations	13	13	8	8
E. Cylinder Handling Safety				
1. Oxygen	13	5	3	3
2. Acetylene	13	5	3	3
3. Propane	0	0	0	0
4. Flamex	2	0	0	0
5. Mapp	0	0	0	0
6. CO_2	3	2	5	2
7. Argon	2	2	4	4
8. Helium	0	0	1	0
9. Hydrogen	0	0	0	0
10. Nitrogen	0	0	0	0
F. Regulator Safety				
1. Construction	7	0	4	3

(Table continued on following page)

(Table I continued)

Welding Page Three	Gas	Shielded Metal Arc	MIG	TIG
2. Adjustments	11	0	8	7
3. Installations	10	0	8	7
4. Setup & Bleeding	10	0	7	7
5. Flashback arrestors	10	0	6	6
G. Welding Torch Safety				
1. Installation & setup	13	2	1	1
2. Equipment maintenance	8	0	1	1
3. Back fire	8	0	0	0
4. Flashback	10	0	0	0
H. Machines and Accessories				
1. AC Machines	0	13	4	7
2. DC Machines	0	12	5	4
3. Guns & cables	0	5	7	7
4. Ground clamp	0	11	7	7
5. Wire drives	0	0	9	0
6. Polarities	0	11	4	5
7. Shielding gas properties	0	5	7	6
8. Electrode ovens	0	6	1	1
I. Filler & Electrode Nomenclature				
1. Identification numbers	4	11	1	1
2. Color code	1	5	0	1
3. Coating function	1	9	0	0
4. Physical properties	2	6	0	2
5. Flux	3	6	0	0

(Table continued on following page)

(Table I continued)

Welding Page Four	Gas	Shielded Metal Arc	MIG	TIG
J. Cutting				
1. Equipment	12	2	0	0
2. Equipment maintenance	11	2	0	0
3. Manipulative techniques	12	2	0	0
4. Cutting Processes				
a. Heavy plate	13	2	0	0
b. Thin stock	12	2	0	0
c. Chamfers	4	0	0	0
d. Circles	4	0	0	0
e. Pipe	3	0	0	0
f. Holes	9	0	0	0
g. Cast Iron	1	0	0	0
h. Powder cutting	1	0	0	0
i. Carbon arc	0	0	0	0
j. Plasma Arc	1	0	0	0
k. Air Arc	0	2	0	0

(Table continued on following page)

(Table I continued)

WELDING PRACTICE	Welding	Brazing
II. Oxyacetylene		
A. Set Up	12	11
B. Tip Selection	12	11
C. Lighting a Torch	12	10
D. Flat Position		
1. Forming puddle	12	6
2. Bead without filler	12	0
3. Bead with filler	11	7
4. Re-start & continue beads	10	6
5. Butt without filler	9	0
6. Butt with filler (open back)	7	8
7. Butt with filler & backing strip multiple pass	1	0
8. Lap		
a. Without filler	5	0
b. With filler single pass	6	3
c. With filler multiple pass	2	1
9. Corner without filler	7	0
10. Multiple pass tee with filler	4	1
E. Horizontal		
1. Beads	6	4
2. Butt without filler	1	0
3. Butt with filler (open back)	5	1
4. Butt with filler & backing strip (beveled)	2	0
5. Lap	3	1

(Table continued on following page)

(Table I continued)

Oxyacetylene
Welding Practice
Page Two

	Welding	Brazing
a. Without filler	1	0
b. With filler single pass	1	1
c. With filler multiple pass	2	1
4. V Butt multiple pass with filler	2	1
F. Vertical Up		
1. Bead without filler	1	0
2. Bead with filler	4	1
3. Lap		
a. Without filler	0	0
b. With filler single pass	3	0
c. With filler multiple pass	1	0
4. Butt without filler	0	0
5. Butt with filler (open back)	3	1
6. Bevel butt with filler & backing strip	1	0
7. Multiple pass tee with filler	0	0
8. Corner without filler	1	0
G. Vertical Down		
1. Bead without filler	1	0
2. Bead with filler	4	0
3. Butt without filler	0	0
4. Butt with filler (open back)	1	0
5. Lap		
a. Without filler	0	0

(Table continued on following page)

(Table I continued)

Oxyacetylene
Welding Practice
Page Three

	Welding	Brazing
b. With filler single pass	2	1
c. With filler multiple pass	0	0
6. T-fillet - 3 passes	0	0
7. Corner without filler	0	0
8. Multiple pass tee joint with filler	0	0
H. Overhead		
1. Bead without filler	1	0
2. Bead with filler	5	1
3. Butt without filler	0	0
4. Butt with filler (open back)	2	0
5. Butt with filler & backing strip	1	0
6. Lap		
a. Without filler	0	0
b. With filler single pass	2	0
c. With filler multiple pass	0	0
7. Multiple pass tee joint with filler	0	0
8. Corner without filler	0	0
I. Testing		
1. Jig bending	2	1
2. Vise bending	11	8
J. Pipe Welding		
1. Root pass	1	0
2. Filler pass	1	0

(Table continued on following page)

(Table I continued)

Oxyacetylene Welding Practice Page Four	Welding	Brazing
3. Finish pass	0	0
E. Specialized Techniques		
1. Flux cored welding	1	0
2. Hard surfacing	1	0
3. Silver soldering	2	0

(Table continued on following page)

(Table I continued)

WELDING PRACTICE	F1-Exx 24	F2-Exx 12-13	F3-Exx 10-11	F4-Exx 18
III. Shielded Metal Arc				
A. Set Up	1	9	3	1
B. Starting an Arc	1	8	3	1
C. Flat Position				
1. Bead with filler	1	7	3	2
2. Re-start & continue beads	1	9	6	2
3. Butt (open back)	1	8	4	1
4. Butt backing strip multiple pass	1	2	3	2
5. Lap				
a. Single pass	1	8	4	1
b. Multiple pass	1	4	2	1
6. Multiple pass tee with filler	1	5	4	1
D. Horizontal				
1. Beads	1	6	5	2
2. Butt (open back)	1	5	4	2
3. Butt backing strip (Beveled)	1	2	3	2
4. Lap				
a. Single pass	1	4	4	1
b. Multiple pass	1	2	2	1
5. V butt multiple pass with filler	1	2	4	2
E. Vertical Up				
1. Bead	1	3	4	2
2. Lap				
a. Single pass	1	3	3	1
b. Multiple pass	1	2	2	1

(Table continued on following page)

(Table I continued)

Shielded Metal Arc Welding Practice Page Two	F1-Exx 24	F2-Exx 12-13	F3-Exx 10-11	F4-Exx 18
3. Butt (open back)	0	1	2	0
4. Bevel butt with backing strip	1	2	3	2
5. Multiple pass tee	1	2	2	1
F. Vertical Down				
1. Bead	1	4	5	2
2. Butt (open back)	0	2	3	0
3. Lap				
a. Single pass	1	1	3	1
b. Multiple pass	1	1	1	1
4. T-fillet - 3 passes	1	3	2	1
5. Multiple pass tee joint	1	1	1	1
G. Overhead				
1. Bead	1	4	5	2
2. Butt (open back)	0	2	3	0
3. Butt with backing strip	1	2	3	2
4. Lap				
a. Single pass	1	3	4	1
b. Multiple pass	1	2	2	1
5. Multiple pass tee joint	1	2	2	1
H. Testing				
1. Jig bending	1	1	2	2
2. Vise bending	1	3	3	1
I. Pipe Welding				

(Table continued on following page)

(Table I continued)

Shielded Metal Arc
Welded Practice
Page Three

	P1-Sec 24	P2-Sec 12-13	P3-Sec 10-11	P4-Sec 18
1. Root pass	0	1	0	0
2. Filler pass	0	0	0	0
3. Finish pass	0	0	1	0

(Table continued on following page)

(Table I continued)

WELDING PRACTICE	MIG - Short Arc	MIG - Spray Transfer	TIG
IV. Mig & Tig			
A. Set Up	7	2	7
B. Starting an Arc	7	2	7
C. Starting a Torch	3	0	7
D. Flat Position			
1. Forming puddle	4	1	7
2. Bead without filler	0	0	7
3. Bead with filler	5	1	6
4. Re-start & continue beads	5	2	6
5. Butt without filler	0	0	5
6. Butt with filler (open back)	3	1	5
7. Butt with filler & backing	2	1	1
8. Lap			
a. Without filler	0	0	1
b. With filler single pass	5	2	4
c. With filler multiple pass	2	0	0
9. Corner without filler	0	0	1
10. Multiple pass tee with filler	4	1	0
E. Horizontal			
1. Beads	5	0	2
2. Butt without filler	0	0	1
3. Butt with filler & backing strip (Inverted)	3	0	0
4. Butt with filler (open back)	2	0	1
5. Lap			

(Table continued on following page)

(Table I continued)

MIG & TIG
Welding Practice
Page Two

	MIG - Short Arc	MIG - Spray Transfer	TIG
a. With filler single pass	1	0	0
b. With filler multiple pass	2	0	0
4. V Butt multiple pass with filler	2	0	0
F. Vertical Up			
1. Bead without filler	0	0	1
2. Bead with filler	2	0	1
3. Lap			
a. With filler single pass	1	0	0
b. With filler multiple pass	1	0	0
4. Butt with filler (open back)	1	0	0
5. Bevel butt with filler & backing strip	1	0	0
6. Multiple pass tee with filler	2	0	0
G. Vertical Down			
1. Bead with filler	2	1	0
2. Butt with filler (open back)	1	0	0
3. Lap			
a. With filler single pass	0	0	0
b. With filler multiple pass	0	0	0
4. T-fillet - 3 passes	1	0	0
5. Corner without filler	0	0	0
6. Multiple pass tee joint with filler	0	0	0
H. Overhead			
1. Bead with filler	1	0	0
2. Butt with filler (open back)	1	0	0

(Table continued on following page)

(Table I continued)

Mig & Tig
Welding Practice
Page Three

	Mig - Short Arc	Mig - Spray Transfer	Tig
3. Butt with filler & backing strip	2	0	0
4. Lap			
a. With filler single pass	1	0	0
b. With filler multiple pass	1	0	0
5. Multiple pass tee joint with filler	1	0	0
I. Testing			
1. Jig bending	2	0	0
2. Vise bending	2	0	0
J. Pipe Welding			
1. Root pass	0	0	0
2. Filler pass	0	0	0
3. Finish pass	0	0	0
K. Specialized techniques			
1. Flux cored welding	1	0	0
2. Hard surfacing	0	0	0

*The data in the cells indicate the number of high schools with the Mid-State VTAE District that stated they teach these tasks to some level of proficiency. When the number in the cell is less than "13," the number after subtracting from 13 indicates the number of high schools not teaching the task.

VI. RESULTS OF STUDY

Following the data analysis, a list of competencies was developed. Visitations to the high schools were again made. After much discussion, changes were made and a list of competencies was developed. This list of competencies was then incorporated into a certificate. The certificate was mailed to all welding instructors for their approval or suggestions. After receiving their suggestions, the Certificate of Achievement was developed (see Appendix D).

The Certificate of Achievement which resulted from this study will coordinate the welding program of the high schools in the Mid-State VTAE District with the Mid-State Vocational Technical Institute welding program.

The high school welding instructors agreed to implement the Certificate of Achievement, and the welding instructors of Mid-State Vocational Technical Institute agreed to recognize the competencies identified by the high schools. The credit given to students will vary. Students whose goal is to get a diploma in welding at Mid-State Vocational Technical Institute will be eligible for advance placement. Students whose goal is a vocational diploma in a trade area other than welding, will be eligible for advance standing.

In addition to the benefits to the students of the Mid-State VTAE District, this project has increased cooperation which will foster future articulation between the high schools and Mid-State Vocational Technical Institute.

VII CONCLUSIONS RECOMMENDATIONS

The results of this study led to several conclusions and recommendations. The tasks which could be learned for job entry positions in welding are not all being learned at the secondary level. The secondary schools, in many cases due to lack of equipment, are not teaching some advanced arc welding skills. Also, because of a lack of teaching personnel, students receive limited instruction in theory of welding. Most secondary schools are doing a good job of teaching welding in a "simple-to-complex" sequence.

Teacher certification requirements to instruct in secondary schools as opposed to post-secondary VTAE schools are different. Secondary school requirements are a bachelor's degree and 2,000 hours of "related" work experience. Requirements for post-secondary VTAE teaching certification are seven years (14,000 hours) trade experience if the person has no bachelor's degree, or two years (4,000 hours) trade experience if the person has a bachelor's degree. This results in a difference in how these instructors view the requirements for their students to attain entry employment. Generally post-secondary VTAE instructors view the job entry requirements as being higher than secondary instructors view these job entry requirements.

Mid-State Technical Institute's welding program needs to be more flexible to meet the broad range of needs of incoming students.

This author recommends that the secondary schools continue to do all they can in providing sound welding programs, beginning with basics in safety and following a "simple-to-complex" sequence through types of welding and welding machines.

It is recommended that competencies the students have mastered be recorded on a Certificate of Achievement. These competencies should be correctly recorded by the secondary school instructor which will enable the post-secondary VTAE school to award the student advanced standing.

The post-secondary VTAE schools must make adjustments in their requirements so that the competencies identified by the secondary school welding instructors will be recognized and that the incoming students may progress without undue overlap or gaps in their welding training.

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APPENDICES

Appendix A

List of Contact Persons in High Schools

Of Mid-State VTAE District

HIGH SCHOOL CONTACTS MAILING LIST

SCHOOL & ADDRESS	WELDING INSTRUCTOR	COUNSELOR	PRINCIPAL	LVEC
Adams-Friendship H.S. Adams, WI 53910 Phone (608) 339-3921	Wayne Schmidt	John L. Sullivan	Donald Kolek	John Jones
Almond High School Almond, WI 54909 Phone (715) 366-2941	Dave Rattle	Lyle J. Campbell	Bill Peterson	Tom Whalley
Tomorrow River H.S. Amherst, WI 54406 Phone (715) 824-5522	Harry Page	Daniel R. McDowell	Walter Bohman	Dennis Cairns
Assumption High School 445 Chestnut Street Wis. Rapids, WI 54494 Phone (715) 423-2920	None	Mrs. Pat Schuetz	Rev. Joseph Irvin	
Auburndale High School Auburndale, WI 54412 Phone (715) 652-2115	John Jenson	Rollie Larson	Glen Denk	Don Conachen
Columbus High School 710 S. Columbus Avenue Marshfield, WI 54449 (715) 387-1177	Jim Birchler	Sister Mark Marie Sister Miranda	Rev. William Grevatch	
Granton High School P.O. Box 148 Granton, WI 54436 Phone (715) 238-7176	Gill Williams	Joseph Dachel	Lyonel Strand	George Moore
Lincoln High School 311 Lincoln Street Wis. Rapids, WI 54494 Phone (715) 423-1520	Dick Smith	Thomas Marshall Ernie Vogler Dorothe Mellen Mahlon Schmidt	Timothy Laatsch	Bruce LaRose

Marshfield Sr. H.S. 1401 Becker Road Marshfield, WI 54449 Phone (715) 387-8464	Richard Johnson	Dean Hawks	Russell Knapp	Marvin Schutts
Nekoosa High School 500 Cedar Street Nekoosa, WI 54457 Phone (715) 886-4500	Bob Mindock	Mrs. Janet Chapley Mr. Jim Goesch	Robert Scamfer	
Pittsville High School Pittsville, WI 54466 Phone (715) 884-6412	Arlan Schuneman	Michael Bonacci	Peter Pavloski	
John Edwards High School 801 Second Street Port Edwards, WI 54469 Phone (715) 887-3150	Steve Day	Clifford Peterson	Herbert Williams	
Pacelli High School 1301 Maria Drive Stevens Point, WI 54481 Phone (715) 341-2442	None	Jeffrey Meidam Barb Portsen	Father Dominic	
Stevens Point Area H.S. 1201 North Point Drive Stevens Point, WI 54481 Phone (715) 346-2022	Bruce Kilsdonk	Ted Mitchell	Ray Kinziger	James Biser
Tri-County High School Plainfield, WI 54966 Phone (715) 335-6366	Don Wied	Larry Hanson	Alex Aschenbrenner	Tom Whalley
West Junior H.S. 1921 S. 27th Avenue Wisconsin Rapids, WI 54494	None	Randolph Neuser Rueben Eckardt	Calvin Hagen	

Appendix B

Minutes of a Meeting of LVEC's

Called to Select a Specific Curriculum Area

Advisory Committee Meeting Minutes
Federal Project
Articulation Secondary & Post Secondary
Vocational Education Curriculums

Date: October 24, 1978

LVEC invited to attend:

Jim Biser	George Moore
Marvin Schutts	Don Conachon
Thomas Whalley	Dennis Carins
John Jones	Bruce LaRose

Messages were received from Mr. Jim Biser and Mr. Marvin Schutts that conflicts were going to make it impossible for them to attend this meeting at the time scheduled.

John Jones from Adams-Friendship, Don Conachon from Auburndale, Bruce LaRose from Wisconsin Rapids were in attendance at this meeting.

Mr. Anhalt, project supervisor, began the meeting with background information which has led us to the position which we are at on our present project. For the past three years, we at Mid-State Technical Institute have been working to establish a system by which students can transfer from high schools in our district to Mid-State Technical Institute with a minimum of repetition. Some of the initial efforts made in this direction were done by Mr. Knobeck, who established working relations with many schools and LVEC's. These efforts also resulted in advance status procedures at Mid-State which enabled students to write-off complete courses in some cases.

As a need for more improved methods of easing student transition between levels of education became apparent, Mr. Knobeck developed a survey instrument, which it was hoped, would identify specific bodies of knowledge which students were repeating at both levels of education. This instrument did identify many areas where overlap was apparent.

Further discussion of the results of the survey conducted by Mr. Knobeck led to the determination that of the three curriculum areas surveyed, there were several reasons to concentrate our efforts on the articulation of the welding curriculum.

First; In the welding curriculum there were more apparent overlaps in materials covered at both levels of education according to the schools surveyed.

Second; The welding curriculum at Mid-State being a one year program, as contrasted with a two year program in both Auto Mechanics and Machine Tool would lend itself to more rapid transition to competency based instruction.

Third; The competencies in welding are developed on stock which can be easily provided, while in auto mechanics it is difficult to provide all students with the specific training or task he may be ready for because of the need to being in outside work in the form of specific auto problems.

The members present highly endorsed the choice of welding as the area of instruction to which we should channel our immediate efforts.

Methods for improved articulation in welding led to the discussion of teacher trading. By having the teachers from each level of education teach at the other instructors level, it was felt more understanding between teachers would be fostered.

The use of WAVAE to create a common bond among instructors was discussed.

The goals of our present project were discussed and the need to establish immediate contact with all welding instructors in the district was emphasized. Dale Hayden will work through the LVEC's to accomplish this.

It was determined that a more complete list of welding competencies be developed with the use of VTECS, the survey instrument used by Mr. Knobeck, and by personal contact with welding instructors in the district.

The need to bring welding instructors together to develop an organized thrust was stated.

The final results of this project are expected to be culminated during a two week workshop at Mid-State where interested welding instructors and other involved persons will bring together information needed to enable high school instructors to identify the competencies they have taught so that their students need not repeat the same competencies upon entering Mid-State.

Another meeting is planned in four to six weeks with welding instructors and interested LVEC's to provide more specific direction for our efforts.

Meeting adjourned at 9:30 p.m.

Respectfully submitted,

Dale Hayden

Appendix C

Task List Sent to High School Welding Instructors

Along With Instruction For Completion

Mid-State Technical Institute

WISCONSIN RAPIDS CAMPUS
Five Hundred 32nd Street North
Wisconsin Rapids, WI 54494
715/423-5650

INSTRUCTIONS FOR TASK LIST

Instructions:

After each task, there are several columns. The columns indicate specific areas to which the task may apply.

If a task is taught in your school in all areas, check every column. If a task is taught in several areas, check only those columns. If a task is taught as it applies to only one area, check only that column. If a task is not taught, do not check.

The level of expertise developed in each task is not a concern at this time. The only information requested is which tasks are being taught.

Thank you
Dale Hayden
Articulation Coordinator

MID-STATE TECHNICAL INSTITUTE
Wisconsin Rapids Campus

WELDING

	Gas	Shielded Metal Arc	Mig	Tig
I. Safety				
A. Shop Safety				
1. Materials (Handling & Storage)				
2. Ventilations				
3. Fire				
a. Extinguishers				
b. Fire classification				
c. Fire blankets				
4. Compressed air usage				
5. Combustibles				
a. Storage				
b. Handling				
6. Injury reporting procedure				
7. Floors & passageways				
8. Attitude				
B. Tool Safety				
1. Hand tools				
2. Power Tools				
a. Drills				
b. Press				
c. Grinders				
d. Shears				
e. Power saws				
f. Weld testing machines				

	Gas	Shielded Metal Arc	Mig	Tig
C. Clothing Safety				
1. Helmets and goggles				
2. Rings, watches & jewelry				
3. Hair protectors				
4. Safety shoes				
5. Fire retardant aprons & vests				
D. Eye Safety				
1. State laws governing eye protection				
2. Types of approved glass				
3. School regulations				
E. Cylinder Handling Safety				
1. Oxygen				
2. Acetylene				
3. Propane				
4. Flamex				
5. Mapp				
6. CO_2				
7. Argon				
8. Helium				
9. Hydrogen				
10. Nitrogen				
F. Regulator Safety				
1. Construction				

Welding
Page Three

	Gas	Shielded Metal Arc	Mig	Tig
2. Adjustments				
3. Installations				
4. Setup & Bleeding				
5. Flashback arrestors				
G. Welding Torch Safety				
1. Installation & setup				
2. Equipment maintenance				
3. Back fire				
4. Flashback				
H. Machines and Accessories				
1. AC Machines				
2. DC Machines				
3. Guns & cables				
4. Ground clamp				
5. Wire drives				
6. Polarities				
7. Shielding gas properties				
8. Electrode ovens				
I. Filler & Electrode Nomenclature				
1. Identification numbers				
2. Color code				
3. Coating function				
4. Physical properties				
5. Flux				

	Gas	Shielded Metal Arc	Mig	Tig
J. Cutting				
1. Equipment				
2. Equipment maintenance				
3. Manipulative techniques				
4. Cutting Processes				
a. Heavy plate				
b. Thin stock				
c. Chamfers				
d. Circles				
e. Pipe				
f. Holes				
g. Cast Iron				
h. Powder cutting				
i. Carbon arc				
j. Plasma Arc				
k. Air Arc				

WELDING PRACTICE

	Welding	Brazing
II. Oxyacetylene		
A. Set Up		
B. Tip Selection		
C. Lighting a Torch		
D. Flat Position		
1. Forming puddle		
2. Bead without filler		
3. Bead with filler		
4. Re-start & continue beads		
5. Butt without filler		
6. Butt with filler (open back)		
7. Butt with filler & backing strip multiple pass		
8. Lap		
a. Without filler		
b. With filler single pass		
c. With filler multiple pass		
9. Corner without filler		
10. Multiple pass tee with filler		
E. Horizontal		
1. Beads		
2. Butt without filler		
3. Butt with filler (open back)		
4. Butt with filler & backing strip (beveled)		
5. Lap		

	Welding	Brazing
a. Without filler		
b. With filler single pass		
c. With filler multiple pass		
6. V Butt multiple pass with filler		
F. Vertical Up		
1. Bead without filler		
2. Bead with filler		
3. Lap		
a. Without filler		
b. With filler single pass		
c. With filler multiple pass		
4. Butt without filler		
5. Butt with filler (open back)		
6. Bevel butt with filler & backing strip		
7. Multiple pass tee with filler		
8. Corner without filler		
G. Vertical Down		
1. Bead without filler		
2. Bead with filler		
3. Butt without filler		
4. Butt with filler (open back)		
5. Lap		
a. Without filler		

	Welding	Brazing
b. With filler single pass		
c. With filler multiple pass		
6. T-fillet - 3 passes		
7. Corner without filler		
8. Multiple pass tee joint with filler		
H. Overhead		
1. Bead without filler		
2. Bead with filler		
3. Butt without filler		
4. Butt with filler (open back)		
5. Butt with filler & backing strip		
6. Lap		
a. Without filler		
b. With filler single pass		
c. With filler multiple pass		
7. Multiple pass tee joint with filler		
8. Corner without filler		
I. Testing		
1. Jig bending		
2. Vise bending		
J. Pipe Welding		
1. Root pass		
2. Filler pass		

	Welding	Brazing
3. Finish pass		
K. Specialized Techniques		
1. Flux cored welding		
2. Hard surfacing		
3. Silver soldering		

WELDING PRACTICE

	F1-Exx 24	F2-Exx 12-13	F3-Exx 10-11	F4-Exx 18
III. Shielded Metal Arc				
A. Set Up				
B. Starting an Arc				
C. Flat Position				
1. Bead with filler				
2. Re-start & continue beads				
3. Butt (open back)				
4. Butt backing strip multiple pass				
5. Lap				
a. Single pass				
b. Multiple pass				
6. Multiple pass tee with filler				
D. Horizontal				
1. Beads				
2. Butt (open back)				
3. Butt backing strip (beveled)				
4. Lap				
a. Single pass				
b. Multiple pass				
5. V butt multiple pass with filler				
E. Vertical Up				
1. Bead				
2. Lap				
a. Single pass				
b. Multiple pass				

	P1-Exx 24	P2-Exx 12-13	P3-Exx 10-11	P4-Exx 18
3. Butt (open back)				
4. Bevel butt with backing strip				
5. Multiple pass tee				
F. Vertical Down				
1. Bead				
2. Butt (open back)				
3. Lap				
a. Single pass				
b. Multiple pass				
4. T-fillet - 3 passes				
5. Multiple pass tee joint				
G. Overhead				
1. Bead				
2. Butt (open back)				
3. Butt with backing strip				
4. Lap				
a. Single pass				
b. Multiple pass				
5. Multiple pass tee joint				
H. Testing				
1. Jig bending				
2. Vise bending				
I. Pipe Welding				

Shielded Metal Arc
Welded Practice
Page Three

	F1-Exx 24	F2-Exx 12-13	F3-Exx 10-11	F4-Exx 18
1. Root pass				
2. Filler pass				
3. Finish pass				

WELDING PRACTICE

	Mig - Short Arc	Mig - Spray Transfer	Tig
IV. Mig & Tig			
A. Set Up			
B. Starting an Arc			
C. Starting a Torch			
D. Flat Position			
1. Forming puddle			
2. Bead without filler			
3. Bead with filler			
4. Re-start & continue beads			
5. Butt without filler			
6. Butt with filler (open back)			
7. Butt with filler & backing			
8. Lap			
a. Without filler			
b. With filler single pass			
c. With filler multiple pass			
9. Corner without filler			
10. Multiple pass tee with filler			
E. Horizontal			
1. Beads			
2. Butt without filler			
3. Butt with filler & backing strip (beveled)			
4. Butt with filler (open back)			
5. Lap			

Mig & Tig
Welding Practice
Page Two

	Mig - Short Arc	Mig - Spray Transfer	Tig
a. With filler single pass			
b. With filler multiple pass			
6. V Butt multiple pass with filler			
F. Vertical Up			
1. Bead without filler			
2. Bead with filler			
3. Lap			
a. With filler single pass			
b. With filler multiple pass			
4. Butt with filler (open back)			
5. Bevel butt with filler & backing strip			
6. Multiple pass tee with filler			
G. Vertical Down			
1. Bead with filler			
2. Butt with filler (open back)			
3. Lap			
a. With filler single pass			
b. With filler multiple pass			
4. T-fillet - 3 passes			
5. Corner without filler			
6. Multiple pass tee joint with filler			
H. Overhead			
1. Bead with filler			
2. Butt with filler (open back)			

	Mig - Short Arc	Mig - Spray Transfer	Tig
3. Butt with filler & backing strip			
4. Lap			
a. With filler single pass			
b. With filler multiple pass			
5. Multiple pass tee joint with filler			
I. Testing			
1. Jig bending			
2. Vise bending			
J. Pipe Welding			
1. Root pass			
2. Filler pass			
3. Finish pass			
K. Specialized Techniques			
1. Flux cored welding			
2. Hard surfacing			

Appendix D

Certificate of Achievement

Certificate of Achievement

This is to certify
that

has completed a course(s) in
the field of welding.
Furthermore this individual has reached performance
levels for various skills.
These and the rating scale
used are attached to this certificate.

_____
Instructor

_____
Administrator

How Skill Is Measured

Each skill on the competency list is defined in terms of observable behavior and it is on his/her observable behavior that the student is rated by their instructor. The rating scale attempts to evaluate performance as an employer or supervisor would evaluate and does not refer to grades received in a specific course.

Levels Of Proficiency

1 – Student acquianted with competency - limited skill.
2 – Student can perform competency under close supervision.
3 – Student can perform competency with minimum supervision.

Secondary School _____

Post Secondary School _____

Extension Education _____

Area – Safety – Oxyacetylene, Shielded Metal Arc, Mig & Tig

	Proficiency 1	2	3
1. Fire extinguisher care & knowledge			
2. Hand tool use			
3. Power tool use			
4. Clothing safety requirements			
5. Appropriate eye protection devices			
6. Appropriate cylinder handling procedure			
7. Appropriate regulator safety practices			
8. Appropriate torch safety practices			

Area – Oxyacetylene Welding & Cutting Competency or Skill

	Proficiency 1	2	3
1. Filler classifications & functions			
2. Principles of gas cutting equipment			
3. Cutting heavy plate			
4. Cutting thin stock			
5. Cutting chamfers			
6. Cutting pipe			
7. Cutting holes			
8. Cutting cast iron			
9. Welding tip selection			
10. Flat position bead with filler (carbon steel)			
11. Flat position butt w/filler			
12. Flat position lap w/filler			
13. Flat position corner without filler			
14. Horizontal butt with filler			
15. Horizontal lap with filler			
16. Vertical up bead with filler			
17. Vertical up lap with filler			
[redacted]			

Area – Shielded Metal Arc Welding (continued)

	Proficiency 1	2	3
26. Vertical Up lap			
27. Vertical Up fillet (tee)			
28. Vertical Up bevel butt w/backing strip			
29. Vertical Up without backing strip			
30. Vertical Down beads			
31. Overhead – beads			
32. Overhead butt – open back			
33. Overhead lap single pass			
34. Overhead tee			
35. Guided bend test			
36. Pipe welding 2 G position			
37. Pipe welding 5 G position			
38. Pipe welding 6 G position			
Other Competencies			
1.			
2.			
3.			
4.			

Area – Gas Metal Arc (Mig) Welding

	Proficiency 1	2	3
1. Welding machines			
2. Welding guns and cables			
3. Shielding gas properties			
4. Filler identification			
5. Polarity			
6. Flat position – beads			
7. [redacted]			

22. Vertical down lap with filler
23. Vertical down corner without filler
24. Overhead – bead with filler
25. Overhead – butt with filler
26. Overhead – lap with filler
27. Overhead – corner without filler
28. Free bend test
29. Pipe welding
30. Brazing
31. Silver soldering
32. Aluminum
33. Cast iron

Other Competencies

1.
2.
3.
4.

Area – Shielded Metal Arc Welding

1. Understands AC machines theory
2. Understands DC machines theory
3. Cables and ground clamp knowledge
4. Understands polarities
5. Electrode ovens
6. Identification and classification (AWS)
7. Electrode coating functions
8. Identifying metals
9. Arc cutting thin stock
10. Arc cutting cast iron
11. Carbon arc cutting
12. Air arc cutting
13. Flat position – running a bead
14. Flat position – re-start and continue beads
15. Flat position – butt (open back)
16. Flat position – butt with backing strip multiple pass
17. Flat position – lap – single pass
18. Flat position – lap – multiple pass
19. Flat position – multiple pass tee
20. Horizontal beads
21. Horizontal butt – open back
22. Horizontal butt (beveled) w/backing strip
23. Horizontal lap – single pass
24. Horizontal lap – multiple pass
25. Vertical Up beads

10.
11. Horizontal butt with backing
12. Horizontal lap
13. Vertical Up – beads
14. Vertical Up lap
15. Vertical Up (tee) fillet
16. Vertical Up beveled butt
17. Vertical Down – beads
18. Vertical Down – fillet
19. Overhead – beads
20. Overhead – butt – beveled w/backing
21. Overhead – fillet
22. Weld testing
23. Pipe welding

Other Competencies

1.
2.
3.
4.

Area – Gas Tungsten Arc (Tig) Welding

1. Welding machine switch selection
2. Shielding gases
3. Air & water cooled torches
4. Filler identification
5. Flat position – beads
6. Flat position butt (open back)
7. Flat position – fillet
8. Flat position corner
9. Horizontal – beads
10. Horizontal – butt – open back
11. Horizontal – lap
12. Vertical Up – beads
13. Vertical Up – lap
14. Vertical Up – fillet (tee)
15. Vertical Up – butt – open back
16. Weld testing
17. Pipe welding

Other Competencies

1.
2.
3.
4.